Ref No: **Ex/EE/T/322/2018**

B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER – 2018

SUBJECT: - POWER ELECTRONICS

Full Marks: 100

Time: Three hours (**50** marks for this part)

Use a separate Answer-Script for each part

No. of Questions		PART -I Answer any Three (Two marks reserved for well organized answers)	Marks
1)	(a)	With the help of different waveforms describe the principle of operation of a single phase half wave diode rectifier with freewheeling diode feeding an R-L load.	(8)
	(b)	Describe the working principle of a three phase half-controlled rectifier with freewheeling diode feeding an R-L load. Also show necessary waveforms.	(8)
2)	(a)	Develop the expression for the output average voltage, input power factor, input displacement factor for a single phase fully controlled bridge rectifier with R-L load. Also draw necessary waveforms.	(8)
	(b)	Develop the expressions for output average and rms voltage of a three phase half wave diode rectifier feeding an inductive load. Also show the effect of source inductance on output voltage. Draw waveforms wherever necessary.	(8)
3)	(a)	Draw the necessary waveforms for output voltage and current for a single phase full wave uncontrolled rectifier feeding R-C parallel load.Also develop the expression for voltage ripple for such rectifier.	(8)
	(b)	A three phase uncontrolled full bridge rectifier fed from 415 V, 50 Hz, three phase a.c. source is connected with an inductive load. The rectifier delivers 30 A to the load. Determine (a) output average votlage (b) input power (c) input power factor. Assume 1V voltage drop for each diode.	(8)
4)	(a)	With the help of necessary circuit diagram and waveforms, show how a single phase fully controlled rectifier can be operated in inverter mode. Also develop the expression for output average voltage for the same.	(8)
	(b)	For the circuit diagram given below, V_s = 300 sin314t Volts. Determine (a) diode rms current, (b) output average voltage, (c) output rms voltage, (d) input rms current at primary side of transformer. Assume the diodes and transformer to be ideal.	(8)

[Turn over

Ref No: **Ex/EE/T/322/2018**

B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER – 2018

SUBJECT: - POWER ELECTRONICS

Full Marks: 100

Time: Three hours (**50** marks for this part)

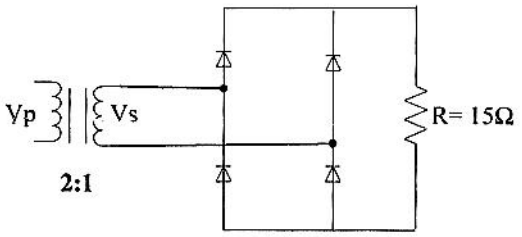

Fig. Q.9.(b)

5)	Write short notes on any *two* of the following: (i) Single phase dual converter. (ii) Three phase fully controlled rectification. (iii) Operation of single phase cyclo-converter for ac-ac voltage conversion.	(2×8)

Ref No. : EX//EE/T/322/2018

B.E. ELECTRICAL ENGINEERING 3RD YEAR 2 ND SEMESTER EXAMINATION, 2018

Time: Three Hours **POWER ELECTRONICS**
Full Marks: 100

Use a separate Answer-Script for each part
PART –II (50 marks)
Answer Question NO.1 and any FOUR questions from the rest.

1.a) As the switching frequency of the power electronic devices increases,the weight and cost of the converter –

(i) Remains same (ii) Decreases (iii) Increases (iv) None of these.

(b) The leakage current of Schottky diode in comparison with that in ordinary power diode for the same temperature rise is-

(i) More (ii) Less (iii) Same (iv) None of these.

(c)The reverse breakdown voltage of SCR is –

(i) 500 Volts (ii) 20to 30 Volts (iii) Less than 100 Volts. (iv) None of these.

(d)The main advantage of IGBT over other power electronic devices is that-

(i) It is available at high power rating (ii) Lower gate drive power required (iii) Lower on state voltage drop (iv) All of these.

e) The main advantage of Buck-Boost chopper is that-

(i) The output voltage is more than the input voltage. (ii) The output voltage is negative with respective to the common input.(iii) Both (i) and (ii) (iv) None of these.

f) Which of the following devices can be used in current source inverter-

(i) Power Transistor (ii) SCR (iii) Power MOSFET (iv) IGBT.

g) In which of the following Inverters, the amplitude of the output current is independent of load-
(i) VSI (ii) CSI (iii) SPWM (IV) None of these.

h) The main disadvantage of Cycloconverter is that-

(i) The output waveform is distorted (ii) The output frequency is more than the input frequency (iii) The output frequency is less than the input frequency(iv) Both (i) and (ii)

i) Which of the following converters gives good performance for the same value of firing angle-

(i) Semiconverter (ii) Fully Controlled Converter (iii) Both (i) and (ii) (iv) None of these.

j) Which of the following converters can not be used as an Inverter-

(i) Single phase semiconverter (ii) Three phase fully controlled converter (iii) Single phase fully controlled converter (iv) Dual converter. 10x1

2. (a) Derive the expression of steady state power loss in a power diode from its V-I characteristic. 5
(b) Exlpain the reverse recovery effect in a power diode. 5

3.(a) Explain why power BJT is operated in Quasi-saturation region. 5
(b) Sketch the structure of power MOSFET and explain its working principle. 5

4.(a) Derive the expression of output voltage of a Boost chopper with the help of necessary circuit diagram and relevant waveforms. Explain why PWM tecnique is prefered over FM tecnique for controlling the duty ratio. 6
(b) A step-up chopper has input voltage of 220 Volts and output voltage of 660 Volts.If the conducting time of the thyristor- chopper is 100 microsecond, compute the pulse width of the output voltage.In case output- voltage pulse width is halved for constant frequency, find the average value of new output voltage. 4

5. (a) Explain the working principle of a Current Source Inverter (CSI) with necessary circuit diagram and relevant waveform for purely resistive load. 5
(b) Explain the working principle of a Full-Bridge inverter for getting distorsionlees output voltage waveforms even in the case of an inductive load. 5

6. Explain the operation of a Switch Mode Power Supply (SMPS) with the help of suitable block schamatic. Explain why the weight,size and cost of SMPS are less than those of Linear Power Supply for the same rating. 10

7. (a) Explain with suitable block schematic, how the duty ratio of a chopper is automatically controlled depending upon the variation of output voltage to get constant D.C.output voltage. 5
(b)Explain the working principle of any one of the Forced Commutation tecniques for turning Off an SCR. 5